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09/980,920	04/11/2002	Michael R. Krause	10002166-2	3383

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EXAMINER

NEURAUTER, GEORGE C

ART UNIT PAPER NUMBER

2143

DATE MAILED: 02/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/980,920

Applicant(s)

KRAUSE ET AL.

Examiner

George C. Neurauter, Jr.

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 January 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Claims 1-34 are currently presented and have been examined.

Response to Arguments

Applicant's arguments filed 6 January 2006 have been fully considered but they are not persuasive.

The Applicant argues that Futral does not teach performing a remote direct memory access operation with a second consumer process from a second endnode to access the contiguous memory address range accessible by a first consumer process at a first endnode including sending the bound remote key and the first address from the second endnode to the first endnode. The Examiner is not persuaded by these arguments.

First, the Examiner notes that the claims are rejected under 35 USC 102(e), not 35 USC 102(b), as alleged by the Applicant in the current response.

Second, the Examiner submits Futral does disclose the claimed invention.

Futral discloses:

"The SAN directly moves the data across the SAN Fabric from the local unit into the desired place in the remote unit without further copies of data being made. To do this, it requires the destination unit to register the memory where the data resides with the SAN NIC. The SAN NIC returns a memory handle as a

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memory protection key. The SAN NIC sends the memory handle and the virtual address of the data to the remote unit to initiate the data transfer. The memory handle and virtual address are sufficient for accessing memory in a particular unit.

Additionally, for access to a remote unit, a platform identifier is used to identify the unit where the memory handle and virtual address are valid. Thus, the combination of a platform identifier, a memory handle for registered memory, and a virtual address uniquely identifies memory located anywhere in the clustered computer system." (column 5, lines 18-42, specifically lines 32-42)

"The mechanism for the I/O device to transfer data beyond the I/O unit's physical memory domain is the ability to create a Remote Direct Memory Access (RDMA) object. A RDMA object identifies memory registered by a process that is accessible by a remote transport agent. The I/O device creates a RDMA object specifying the platform ID. The RDMA allows the I/O device to directly use the transport for transferring data between the I/O device and a remote process. If a suitable virtual interface (VI) does not exist, the I/O Unit creates a VI and connects it to the remote process. Once the RDMA object is created, the I/O device uses it to access the remote transport capabilities of

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the I/O Unit and move data directly to and from the originator's buffers." (column 7, lines 5-17)

Note that Futral expressly discloses that the memory range that can be accessed can be scattered, rather than contiguous, and allocated as page frames, therefore, Futral does suggest that the memory range may also be contiguous and does not teach away from having a contiguous memory range. See column 5, lines 43-56 ("Units pass data to each other by providing a structured list of memory addresses that specifies data buffers and their respective lengths. A data buffer is memory shared between a sender and receiver for the purpose of holding I/O data. The memory of a data buffer can be scattered, rather than contiguous, and allocated as page frames. This mechanism for communicating the location of data to be transferred within the SAN is generally called a data descriptor list. In an embodiment of the present invention, the data descriptor list is called a Scatter-Gather List (SGL). The SGL can indicate any number of buffers, each of which can contain any number of segments (memory fragments). The information passed from sender to receiver explicitly defines the data buffers involved in each remote I/O transaction.")

As shown previously by the Examiner, a second endnode containing a consumer process accesses a first endnode

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containing a consumer process by sending a bound remote key or "memory handle" as disclosed in Futral that has been "registered" and a first address representing a contiguous memory range at the first endnode from the second endnode to the first endnode. Therefore, Futral does disclose these limitations and the claims are not in condition for allowance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 6-7, 9-13, 16-17, 19-20, 23-29, and 32-33 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent 5 991 797 to Futral et al.

Regarding claim 1, Futral discloses a method of managing memory in a distributed computer system, the method comprising:

binding ("register") a remote key ("memory handle") to a first address representing a contiguous memory address range

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accessible by a first consumer process at a first endnode;
(column 5, lines 18-42, specifically lines 24-34)

sending the bound remote key and first address from the
first endnode to a second endnode on a communication fabric
("SAN fabric"); (column 5, lines 18-42, specifically lines 32-
34) and

performing a remote direct memory access operation with a
second consumer process from the second endnode to access the
contiguous memory address range including sending the bound
remote key and the first address from the second endnode to the
first endnode on the communication fabric. (column 5, lines 18-
42, specifically lines 31-42; column 7, lines 5-17)

Regarding claim 2, Futral discloses the method of claim 1
further comprising controlling local memory access protection in
the first endnode with a virtual memory manager in an operating
system kernel process. (column 4, lines 51-65; column 5, lines
6-23)

Regarding claim 6, Futral discloses the method of claim 1
wherein the first address is an effective address ("virtual
address") pointing to an address space in memory accessible by a
consumer process. (column 3, lines 50-58; column 5, lines 5-17
and 39-56)

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Regarding claim 7, Futral discloses the method of claim 6 wherein the effective address points to a virtual address space. (column 3, lines 50-58; column 5, line 43-56)

Regarding claim 9, Futral discloses the method of claim 6 wherein the consumer process is a user process. ("application program"; column 1, lines 8-11)

Regarding claim 10, Futral discloses the method of claim 6 wherein the consumer process is a kernel process. ("virtual interface"; column 3, lines 15-58; column 4, lines 51-65)

Regarding claim 11, Futral discloses the method of claim 1 wherein the first address is a virtual address accessible by a consumer kernel process. (column 3, lines 50-58; column 4, lines 51-65; column 5, lines 5-17 and 39-56)

Regarding claim 12, Futral discloses the method of claim 1 wherein the binding includes associating the first address to the remote key with a consumer process employing a bind remote key verb. (column 5, lines 18-42, specifically lines 29-31)

Regarding claim 13, Futral discloses the method of claim 1 further comprising obtaining at least one remote key with a consumer process employing an allocate remote key verb. (column 5, lines 18-42, specifically lines 31-32)

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Regarding claim 16, Futral discloses the method of claim 1 wherein the remote key cannot be used to protect more than one memory region at a given instant. (column 5, lines 39-42)

Regarding claim 17, Futral discloses the method of claim 1 further comprising reusing the remote key after the remote direct memory access operation from the second endnode is completed. (column 5, lines 23-42)

Claims 19-20, 23-29, and 32-33 are also rejected since these claims recite a distributed computer system that contains substantially the same limitations as recited in claims 1-2, 6-7, 9-13, and 16-17 respectively.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

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1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 3-5, 8, 21-22, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Futral et al. in view of US Patent 6 647 423 to Regnier et al.

Regarding claim 3, Futral discloses the method of claim 1.

Futral does not expressly disclose the method further comprising comparing the bound remote key and the corresponding first address supplied by the second endnode to the bound remote key and corresponding first address in the first endnode,

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however, Futral does disclose using the bound remote key and the corresponding first address for validation purposes (column 5, lines 32-42; column 7, lines 17-34, specifically lines 26-34)

Regnier does disclose comparing the bound remote key and the corresponding first address supplied by the second endnode to the bound remote key and corresponding first address in the first endnode (column 5, line 66-column 6, line 61, specifically column 6, lines 35-44 and 54-61)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of these references since Regnier discloses that comparing the bound remote key and corresponding first address supplied by the second endnode to the bound remote key and corresponding first address in the first endnode enables verification that the information to be transferred is correct and prevents transaction of data if there is a mismatch (column 5, line 66-column 6, line 61, specifically column 6, lines 35-44 and 54-61). In view of these specific advantages and that the references are directed to performing remote direct memory accesses between endnodes over a communication fabric, one of ordinary skill would have been motivated to combine these references and would have considered them to be analogous to one another based on their related fields of endeavor, which would

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lead one of ordinary skill to reasonably expect a successful combination of the teachings.

Regarding claim 4, Futral and Regnier disclose the method of claim 3.

Futrak does not expressly disclose wherein if the bound remote key and corresponding first address supplied by the second endnode do not match the bound remote key and first address in the first endnode, the second endnode is not granted access to the contiguous memory address range, however, Futral does disclose using the bound remote key and the corresponding first address for validation purposes (column 5, lines 21-23 and 32-42; column 7, lines 17-34, specifically lines 26-34)

Regnier discloses that if the bound remote key and corresponding first address supplied by the second endnode do not match the bound remote key and first address in the first endnode, the second endnode is not granted access to the contiguous memory address range (column 5, line 66-column 6, line 61, specifically column 6, lines 35-44 and 54-61).

Claim 4 is rejected since the motivations regarding the obviousness of claim 3 also apply to claim 4.

Regarding claim 5, Futral and Regnier disclose the method of claim 3.

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Futral does not expressly disclose wherein if the contiguous memory address range represented by the first address bound to the remote key supplied by the second endnode is invalid, the second endnode is not granted access to the contiguous memory address range, however, Futral does disclose using the bound remote key and the corresponding first address for validation purposes (column 5, lines 21-23 and 32-42; column 7, lines 17-34, specifically lines 26-34)

Regnier discloses wherein if the contiguous memory address range represented by the first address bound to the remote key supplied by the second endnode is invalid, the second endnode is not granted access to the contiguous memory address range (column 5, line 66-column 6, line 61, specifically column 6, lines 35-44 and 54-61).

Claim 5 is rejected since the motivations regarding the obviousness of claim 3 also apply to claim 5.

Regarding claim 8, Futral discloses the method of claim 7.

Futral does not expressly disclose the method further comprising comparing the bound remote key and the corresponding first virtual address supplied by the second endnode to the bound remote key and corresponding first virtual address in the first endnode and handling a page fault condition in the first endnode caused by the first virtual address bound to the remote

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key supplied by the second endnode not being previously mapped by an operating system of the first endnode, however, Futral does disclose using the bound remote key and the corresponding first address for validation purposes (column 5, lines 32-42; column 7, lines 17-34, specifically lines 26-34).

Regnier discloses comparing the bound remote key and the corresponding first virtual address supplied by the second endnode to the bound remote key and corresponding first virtual address in the first endnode and handling a page fault condition ("memory protection fault") in the first endnode caused by the first virtual address bound to the remote key supplied by the second endnode not being previously mapped by an operating system of the first endnode (column 5, line 66-column 6, line 61, specifically column 6, lines 35-44 and 54-61).

Claim 8 is rejected since the motivations regarding the obviousness of claim 3 also apply to claim 8.

Claims 21-22 and 25 are also rejected since these claims recite a distributed computer system that contains substantially the same limitations as recited in claims 4-5 and 8 respectively.

Claims 14-15, 18, 30-31, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Futral et al. in view of US Patent 6 360 220 to Forin.

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Regarding claim 14, Futral discloses the method of claim 1.

Futral does not expressly disclose the method further comprising unbinding the remote key from the first address with a consumer process employing an unbind remote key verb, however, Forin does disclose this limitation (column 21, line 66-column 22, line 19, specifically column 22, lines 16-19) (see also Figure 8)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of these references since Forin discloses that unbinding the remote key enables the remote key that is no longer needed to be removed to allow for other remote keys to be stored (column 23, lines 29-32). In view of these specific advantages and that the references are directed to using binded remote keys in order to transfer data over a communication fabric using a consumer process, one of ordinary skill would have been motivated to combine these references and would have considered them to be analogous to one another based on their related fields of endeavor, which would lead one of ordinary skill to reasonably expect a successful combination of the teachings.

Regarding claim 15, Futral discloses the method of claim 13.

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Futral does not expressly disclose the method further comprising retiring at least one remote key that was previously obtained via the allocate remote key verb with the consumer process employing a deallocate remote key verb, however, Forin does disclose this limitation (column 21, line 66-column 22, line 19, specifically column 22, lines 16-19) (see also Figure 8 and 10)

Claim 15 is rejected since the motivations regarding the obviousness of claim 14 also apply to claim 15.

Regarding claim 18, Futral discloses the method of claim 1.

Futral does not expressly disclose the method further comprising disabling a translation for the remote key after the remote key is used for the remote direct memory access operation from the second endnode, however, Forin does disclose this limitation (column 21, line 66-column 22, line 19, specifically column 22, lines 16-19) (see also Figure 8)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of these references since Forin discloses that disabling a translation for the remote key after the remote key is used for the remote direct memory access operation from the second endnode enables the remote key to be removed to allow for other remote keys to be stored (column 23, lines 29-32). In view of

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these specific advantages and that the references are directed to using binded remote keys in order to transfer data over a communication fabric using a consumer process, one of ordinary skill would have been motivated to combine these references and would have considered them to be analogous to one another based on their related fields of endeavor, which would lead one of ordinary skill to reasonably expect a successful combination of the teachings.

Claims 30-31 and 34 are also rejected since these claims recite a distributed computer system that contain substantially the same limitations as recited in claims 14-15 and 18 respectively.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated

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from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Neurauter, Jr. whose telephone number is (571) 272-3918. The examiner can normally be reached on Monday through Friday from 9AM to 5:30PM Eastern.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wiley can be reached on (571) 272-3923. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

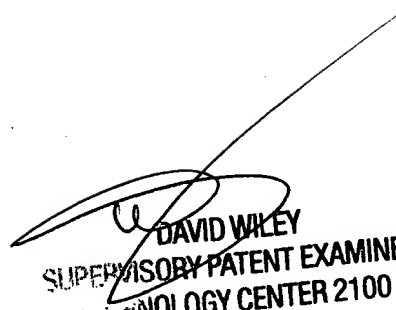
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